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Revision 0

Second Semiannual Report for 2011 Post-Closure Corrective Action Groundwater Monitoring at the 183-H Solar Evaporation Basins and 300 Area Process Trenches: July - December 2011

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

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Executive Summary

This is the second 2011 semiannual report on post-closure corrective action groundwater monitoring for the 183-H Solar Evaporation Basins and the 300 Area Process Trenches. It fulfills the requirement of WAC 173-303-645(11)(g)[1] to report twice each year on the effectiveness of the corrective action program. This report covers the period from July through December 2011. Environmental data used to generate this report are available from the 2012 Environmental Dashboard Application. Ongoing validation, verification, and technical review efforts may result in differences between the data used for this publication and those available after publication of this report via the environmental data access tool.

183-H Solar Evaporations Basins Groundwater Monitoring

Chromium concentrations in the unconfined aquifer remained below permit concentration limits. Both nitrate and uranium exceeded the permit concentration limit. Nitrate increases are most likely related to movement of existing nitrate in the aquifer. Uranium observed above the permit concentration in October may be related to newly mobilized uranium from the rewetted zone after high river stage, or movement of existing uranium in the aquifer. The source of the uranium increases will become clear as additional water level and uranium measurements are made.

Hexavalent chromium in 199-H4-12C results from historical releases, remaining above permit concentration limits and *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*[2] (CERCLA) remedial action objectives. With addition of 199-H4-12C to the pump-and-treat system, corrective action through the CERCLA interim action remains effective.

300 Area Process Trenches Groundwater Monitoring

The June 2011 sample result from Well 399-1-17 was initially reported at 96 µg/L. However, a split from that sample had a concentration of over 2,000 µg/L. Because of this irregularity, the initial sample was re-analyzed. The result from the reanalysis was

[1] WAC 173-303-645, "Dangerous Waste Regulations," "Releases from Regulated Units," Washington Administrative Code, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303-645.

[2] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

4,030 µg/L. These values are abnormally high. The previous maximum concentration at that well was 155 µg/L in June of 2006.

The interaction of groundwater with the contaminated soil column, especially at the rewetted zone where the contaminant is more readily available to the groundwater, allows for ongoing release to the groundwater during periods of high water. These contaminants may continue to enter the aquifer water by dissolution, diffusion, or ionic exchange processes as the water table fluctuates and re-wets the soil matrix. A very high river stage occurred in May/June of 2011 resulting in an unusually high water table at the waste site, allowing for uranium trapped in the usually dry soil to be released to the water column and causing the high concentrations.

Abnormally high uranium concentrations were observed in July and August 2011 (ranging from 441 µg/L to 301 µg/L). The December sample returned to expected concentrations. Uranium in groundwater downgradient of the 300 Area Process Trenches remained above the 20 µg/L concentration limit in three wells screened at the water table.

Cis-1,2-dichloroethene remained above the 70 µg/L permit concentration limit in one deep well (399-1-16B). Trichloroethene was measured slightly above the detection limit in deep Well 399-1-16B, and is not observed in the remaining wells. Corrective actions through the CERCLA interim action (attenuation and institutional controls) have been effective for trichloroethene, and moderately effective for uranium. The CERCLA remedial investigation/feasibility study for the 300-FF-5 Operable Unit will further evaluate the feasibility of remedies for these constituents.

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Terms

bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DWS	drinking water standard
gpm	gallons per minute
OU	operable unit
RAO	remedial action objective
RCRA	*Resource Conservation and Recovery Act of 1976*
RI/FS	remedial investigation/feasibility study
RUM	Ringold Formation upper mud

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1 Introduction

This second 2011 semiannual report for post-closure corrective action groundwater monitoring describes the effectiveness of corrective action at the 183-H Solar Evaporation Basins (waste site 116-H-6) and the 300 Area Process Trenches. It fulfills the requirement of WAC 173-303-645(11)(g), "Dangerous Waste Regulations," "Releases from Regulated Units," to report twice each year on the effectiveness of the corrective action program. This report covers the period from July through December 2011. Chapter 2 presents information for the 183-H Solar Evaporation Basins, and Chapter 3 presents information for the 300 Area Process Trenches.

Environmental data used to generate this report are available from the 2012 Environmental Dashboard Application. Ongoing validation, verification, and technical review efforts may result in differences between the data used for this publication and those available after publication of this report via the environmental data access tool.

2 183-H Solar Evaporation Basins

Formerly located in the 100-H Area of the Hanford Site, the 183-H Solar Evaporation Basins were four concrete basins used for waste treatment and disposal from 1973 to 1985. The waste discharged to the basins originated in the 300 Area Fuel Fabrication Facility and included solutions of neutralized chromic, hydrofluoric, nitric, and sulfuric acids. The waste solutions contained various metallic and radioactive constituents (e.g., chromium, technetium-99, and uranium). Between 1985 and 1996, the remaining waste was removed, the facility was demolished, and underlying contaminated soil was removed and replaced with clean fill. The site is a post-closure unit in the Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*). Groundwater is monitored in accordance with WAC 173-303-645(11) and Part VI, Chapter 2 of the Hanford Facility RCRA Permit (WA7890008967).

The regulations in WAC 173-303-645(11) require implementation of a corrective action program to reduce contaminant concentrations in groundwater. The post-closure plan (DOE/RL-97-48, *183-H Solar Evaporation Basins Postclosure Plan*) was incorporated into Part VI of the Hanford Facility RCRA Permit (WA7890008967) in February 1998. The plan deferred further groundwater corrective action at the basins to the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) interim action for the 100-HR-3 Groundwater Operable Unit (OU). The post-closure plan (DOE/RL-97-48) also requires monitoring to be conducted as described in the Hanford Facility RCRA Permit (WA7890008967) groundwater monitoring plan for this facility (PNNL-11573, *Groundwater Monitoring Plan for the 183-H Solar Evaporation Basins*).

2.1 100-HR-3 CERCLA Interim Remedial Action

The interim remedial action for groundwater contamination in the 100-HR-3 Groundwater OU is implemented under the authority of a CERCLA Interim Record of Decision (EPA 1996a, *Declaration of the Record of Decision for the USDOE Hanford 100 Area 100-HR-3 and 100-KR-4 Operable Units, Hanford Site, Benton County, Washington*). The objective of the interim remedial action is to reduce the amount of chromium entering the Columbia River, where it is a potential hazard to the ecosystem. To achieve this objective, a pump-and-treat system has been implemented to extract groundwater, treat it to remove hexavalent chromium, and inject it back into the aquifer. Figure 1 illustrates the active extraction and injection wells during the reporting period. Details of the pump-and-treat system are specified in

DOE/RL-96-84, *Remedial Design and Remedial Action Work Plan for the 100-HR-3 and 100-KR-4 Groundwater Operable Units' Interim Action*).

Construction of the new 3028 Liters per minute (Lpm) (800 gallons per minute [gpm]) HX pump-and-treat system was completed and started during the reporting period. The new system replaced the aging 1136 Lpm (300 gpm) HR-3 pump-and-treat system. Together with the 2271 Lpm (600 gpm) DX pump, the 100-HR-3 OU interim action has the expanded capacity to hydraulically contain and remediate hexavalent chromium contaminated groundwater throughout the OU.

A remedial investigation/feasibility study (RI/FS) is being conducted, and a Draft A RI/FS report will be issued during 2012. As part of the RI/FS field activities, a new borehole (C7860) was installed through the former 183-H Solar Evaporation Basins (at the middle of sedimentation Basin 1) and completed as a temporary well (199-H4-84). The highest total chromium concentration measured in soil samples collected from the borehole was 13.9 mg/kg, which is less than background. The highest measured hexavalent chromium concentration was 1.07 mg/kg, which was collected at a depth of 11.3 m (37 ft) below ground surface (bgs). Groundwater samples collected from the borehole report a total chromium concentration of 4 µg/L, while hexavalent chromium concentrations were less than the detection limit. Subsequently, the borehole was completed as a temporary well. Groundwater samples collected from the temporary well exhibited total chromium and hexavalent chromium concentrations of 28.6 µg/L and 25 µg/L, respectively.

All uranium results measured in soil samples were less than background. While Technetium-99 was not detected in the two sample intervals above 4.6 m (15.1 ft), it was detected a low concentrations throughout the remainder of the borehole. The highest activity measured was 0.544 pCi/g, occurring at the water table (12.1 m [39.8 ft] bgs).

Nitrate was observed above background in samples collected between 9.8 and 12.1 m (32 to 39.8 ft) bgs. The maximum concentration measured was 81.7 mg/kg (as NO_3), or 26.9 mg/kg total nitrogen. Fluoride was not detected above background in any samples.

Groundwater is sampled to monitor the performance of the interim action and the 100-HR-3 Groundwater OU (DOE/RL-96-90, *Interim Action Monitoring Plan for the 100-HR-3 and 100-KR-4 Operable Units*). Activities for CERCLA and RCRA monitoring are coordinated. A revision of the Remedial Design/Remedial Action Work Plan and Interim Action Monitoring Program is underway to address the DX and HX systems.

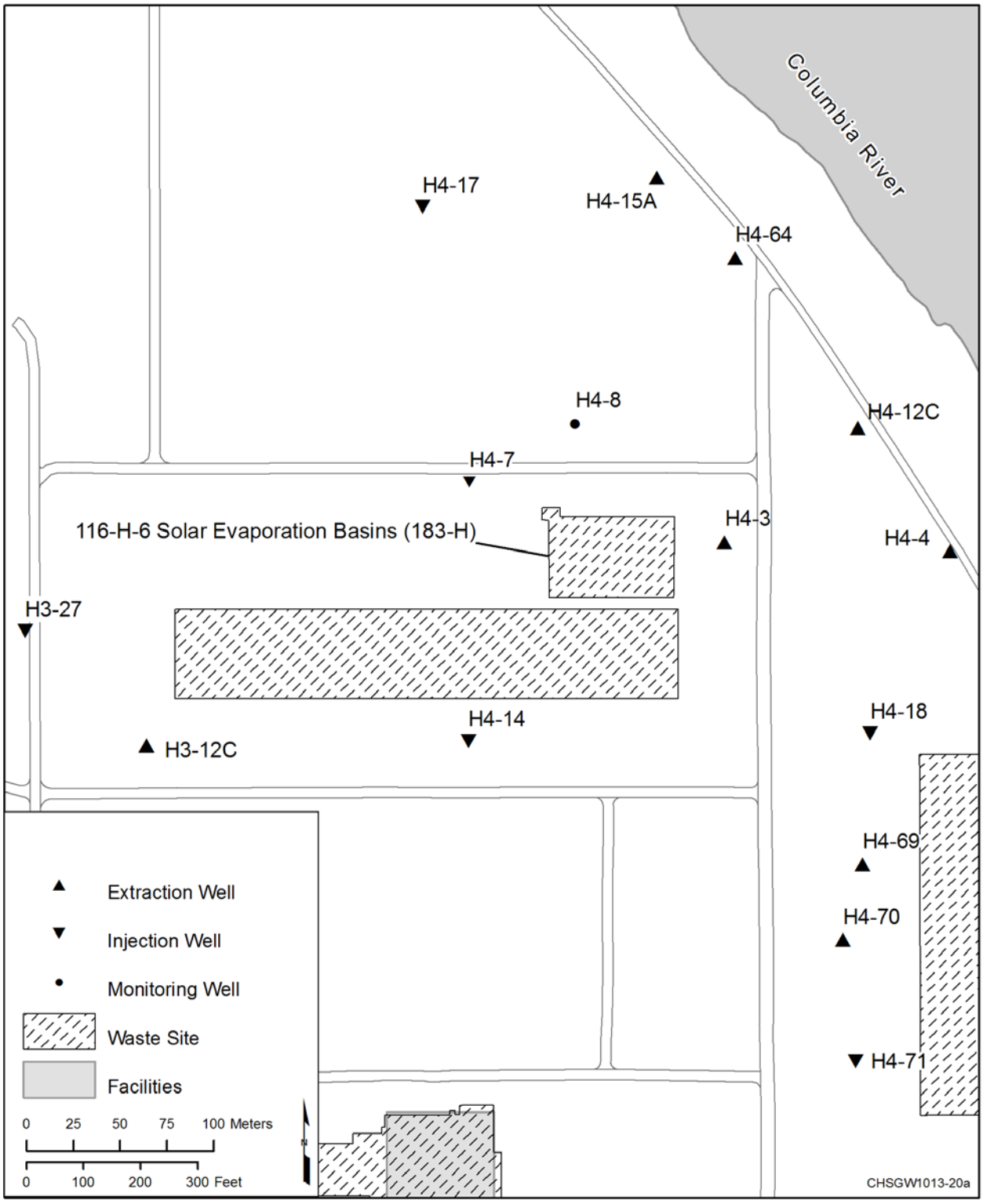


Figure 1. Monitoring Well Locations for 183-H (116-H-6) Basins

2.2 183-H Basins RCRA Groundwater Monitoring Program

During the CERCLA interim remedial action, RCRA corrective action monitoring will continue to evaluate analytical results relative to permit concentration limits (Table 1). Additionally, fluoride results will be evaluated relative to established trends and the drinking water standard (DWS) for fluoride[3] (Hanford Facility RCRA Permit [WA7890008967], Part VI, Chapter 2).

Table 1. Permit Concentration Limits for 183-H Solar Evaporation Basins

Dangerous Waste Constituents	Concentration Limit
Chromium (total; filtered sample)	122 µg/L – local background when compliance monitoring plan written (1996); upgradient sources
Nitrate	45 mg/L – DWS (as NO_3)
Other 183-H Waste Indicators	**Concentration Limit**
Technetium-99	900 pCi/L – DWS
Uranium (total; chemical analysis)	20 µg/L – proposed DWS when monitoring plan written (1996)

DWS = drinking water standard

The RCRA groundwater monitoring network includes Wells 199-H4-3, 199-H4-8, 199-H4-12A, and 199-H4-12C (Figure 1). The conditions in the Hanford Facility RCRA Permit (WA7890008967), Part VI, Post-Closure Unit 2, provide for annual groundwater sample collection from these wells. The wells were sampled for RCRA constituents during October, November, and December. Well 199-H4-12C was sampled to measure hexavalent chromium concentrations to monitor the 100-HR-3 CERCLA interim action.

Well 199-H4-12C is an extraction well. Though still sampled, Well 199-H4-3 was removed from extraction service because of low production and impending waste site remediation activities. After the 100-H aquifer test and rebound study (SGW-47776, *Aquifer Testing and Rebound Study in Support of the 100-H Deep Chromium Investigation*), Well 199-H4-12C was added to the extraction network, replacing Well 199-H4-12A. Well 199-H4-8 has been part of the RCRA network since 2006; it replaced Well 199-H4-7, which was converted to an injection well for the 100-HR-3 Pump-And-Treat System.

Wells 199-H4-3, 199-H4-8, and 199-H4-12A are fully screened in the unconfined aquifer. Well 199-H4-12C is located adjacent to Well 199-H4-12A and is completed deeper within the Ringold Formation upper mud (RUM).

2.3 183-H Basins Contaminant Trends

This section discusses the concentrations of chromium, fluoride, nitrate, technetium-99, and uranium in the groundwater. During the reporting period, four wells were scheduled for sampling (199-H4-3, 199-H4-8, 199-H4-12A, 199-H4-12C). Results from the sampling are presented in Table 2.

[3] The RCRA Permit (WA7890008967) gives the value 1,400 µg/L as the U.S. Environmental Protection Agency maximum contaminant level (DWS) for fluoride. The actual limit is 4,000 µg/L.

Table 2. Groundwater Data for 183-H Basins, July through December 2011

Well	Date	Hexavalent Chromium (µg/L)		Chromium, total (µg/L)		Fluoride (µg/L)		Nitrate (mg/L)		Technetium-99 (pCi/L)		Uranium (µg/L)
Permit Concentration Limit[b]		***122***		***122***		***1,400***		***45***		***900***		***20***
199-H4-12A	8/17/2011	4.1	B	—	U	100	BD	16.8	D	4.2	U	3.2
	11/29/2011	3.7	U	10.8		140		30.5	DH	28.3		9.49
199-H4-12C	9/12/2011[a]	**147**		—		—		—		—		—
	9/19/2011[a]	**145**		—		—		—		—		—
	9/26/2011[a]	**143**		—		—		—		—		—
	10/3/2011[a]	**133**		—		—		—		—		—
	11/1/2011[a]	**141**		—		—		—		—		—
	12/5/2011[a]	**135**		—		—		—		—		—
	12/14/2011	**137**	A	**143**		170		7.53	D	5.14	U	1.06
199-H4-3	8/11/2011	19.2		21	B	106	BD	**49.1**	D	—		—
	10/12/2011	14.7		19.9		199	D	**72.2**	D	157		**28.9**
199-H4-8	11/29/2011	3.7	U	29		140		15.1	DH	-2.78	U	1.08

Notes: Analyses are from unfiltered samples unless otherwise noted.

a. These samples were collected to monitor performance of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* interim action.

b. Concentration limits are defined in WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste* (Part VI, Post-Closure Unit 2).

Italics indicates the Permit Concentration Limits

Shading indicates filtered samples.

Bold emphasis added where the result exceeded the permit concentration limit.

Qualifiers:

A = Potential issue with chain of custody
B = Analyte was found in the associated blank
D = dilution
H = potential issue with hold time
U = below detection limit

In the unconfined aquifer, chromium concentrations ranged from below detection limits to a maximum of 29 µg/L in 199-H4-8 (Table 2; Figures 2, 3, and 4). Chromium concentrations have remained below the 122 µg/L permit concentration limit in all three wells in the unconfined aquifer since 2003.

Hexavalent chromium concentrations observed in 199-H4-12C are from historical releases at other sources, not releases from the 183-H Solar Evaporation Basin. This conclusion is discussed further in the previous semiannual report (SGW-52135, *First Semiannual Report for 2011 Post-Closure Corrective Action Groundwater Monitoring at the 183-H Solar Evaporation Basins and 300 Area Process Trenches*). The exceedance of the CERCLA remedial action objectives (RAOs) (20 µg/L) and permit concentrations (122 µg/L) in 199-H4-12C were addressed by connecting Well 199-H4-12C to the pump-and-treat system.

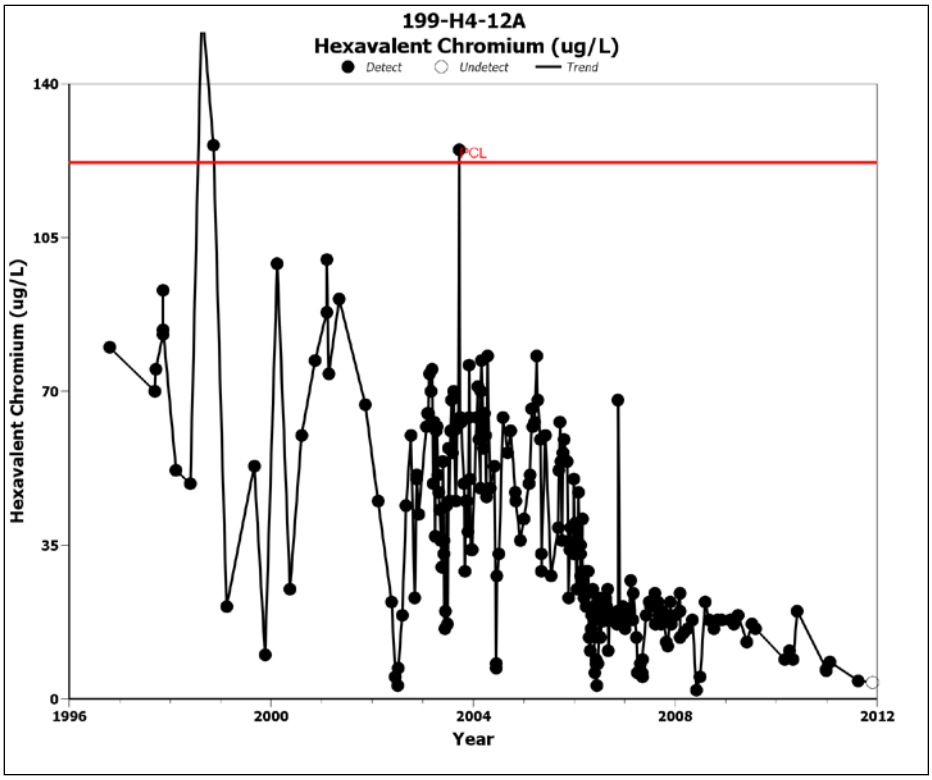


Figure 2. Hexavalent Chromium Concentrations in Well199-H4-12A

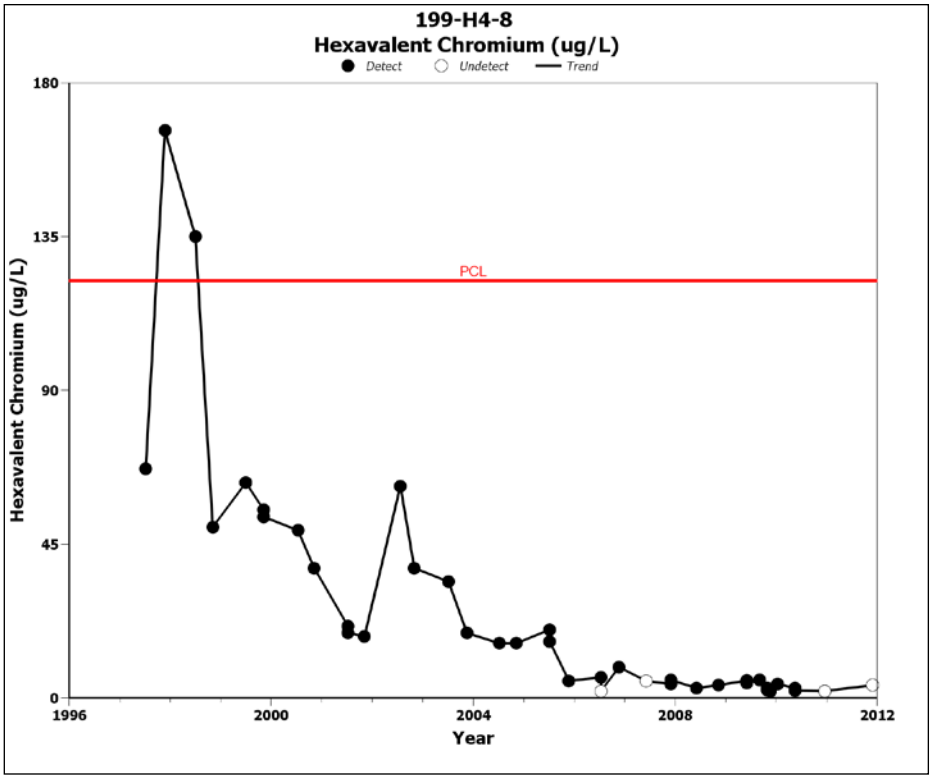


Figure 3. Hexavalent Chromium Concentrations in Well 199-H4-8

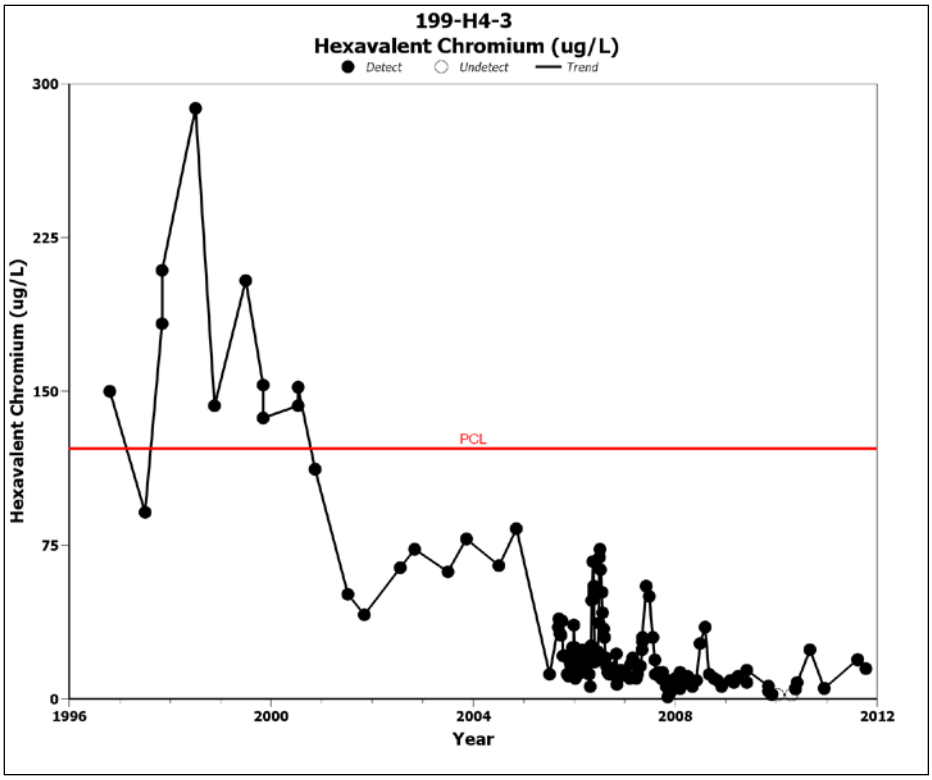


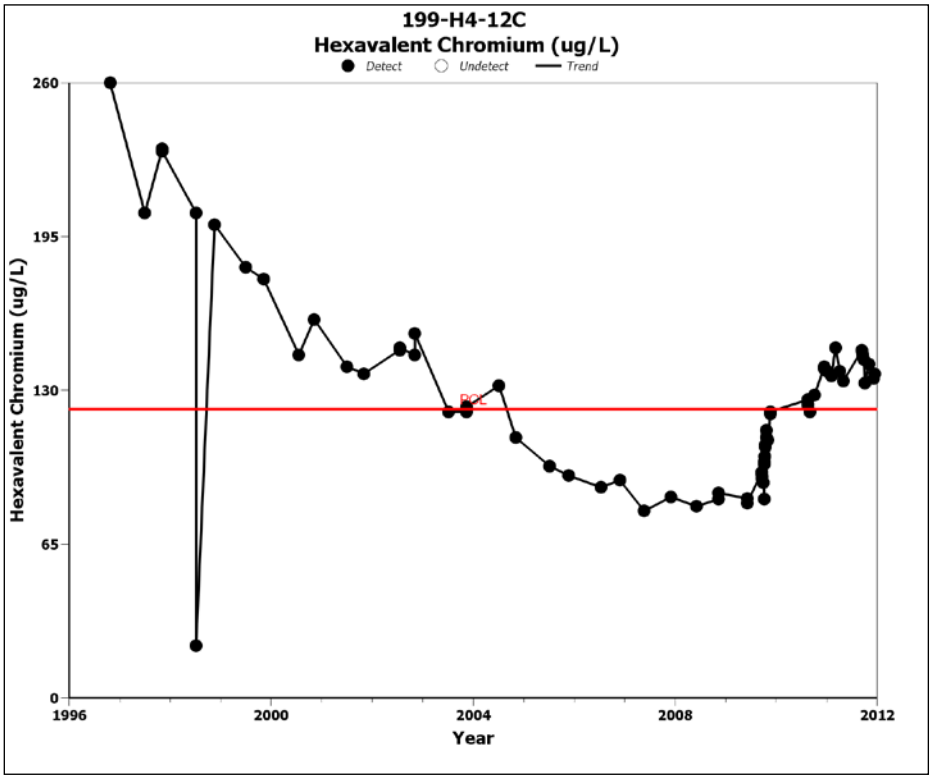
Figure 4. Hexavalent Chromium Concentrations in Well 199-H4-3

The high concentrations measured in 199-H4-12C (133 to 147 µg/L) reflect contamination from these past releases entering RUM. Concentrations measured in this well declined from about 300 µg/L in the early 1990s and were stable until 2009, when the well was connected to the HR-3 pump-and-treat system (Figure 5). Since connection, hexavalent chromium concentrations have climbed as contaminated groundwater is pulled into the extraction well.

As observed in Figure 6, the concentration of nitrate in 199-H4-3 exceeded the permit concentration limit (45 mg/L) in both the August and October samples, with values of 49.1 mg/L and 72.2 mg/L, respectively. Nitrate concentrations last exceeded the permit concentration limit in May 2007. Since then, nitrate concentrations ranged from 27.4 mg/L to 39.8 mg/L. Concentrations observed during the reporting period are related to the movement of existing contamination in the unconfined aquifer, not a new release from the vadose zone below the 183-H Solar Evaporation Basin. While the nitrate increases could result from releases through the periodic rewetted zone, water level trends do not strongly correlate to nitrate concentration changes (Figure 6). This relationship will continue to be evaluated as new nitrate and water level measurements are collected.

Uranium observed in the October sample from 199-H4-3 measured 28.9 µg/L, exceeding the permit concentration limit of 20 µg/L. This well previously exceeded the permit concentration limit in May 2007. Since then samples have ranged between 6.6 µg/L and 14.4 µg/L. The most likely cause for this increase in uranium concentration is from the unusually high river stage observed in the spring in 2011. The interaction of groundwater with the contaminated soil column, especially at the rewetted zone where the contaminant is more readily available to the groundwater, allows for ongoing release to the groundwater during periods of high water. These contaminants may continue to enter the aquifer water by dissolution, diffusion, or ionic exchange processes as the water table fluctuates and re-wets the soil matrix. The unusually high, and near record levels of river stage caused a correspondingly higher water

table in areas near the river. River stage was also sustained during the sampling time frame. Water rising into the overlying zone of contamination increases the rate at which it discharges to the groundwater, causing a temporary peak in concentrations.



Note: Recent increasing concentrations coincide with the 2009 addition of the well to the pump-and-treat system.

Figure 5. Hexavalent Chromium Concentrations in Well 199-H4-12C

Insufficient data are available to determine if the high measurement results from movement of existing contamination, or given the proximity of 199-H4-3 to the river, a release from the periodic rewetted zone after high river stage (Figure 7). This hypothesis will continue to be evaluated as new uranium and head measurements are collected.

Fluoride concentrations observed in the four wells remain significantly below the permit concentration limit of 1,400 µg/L. As depicted in Figures 7, 8, 9, and 10, fluoride concentrations measured this reporting period are higher than in recent reporting periods. However, the fluoride concentrations continue their overall downward trend.

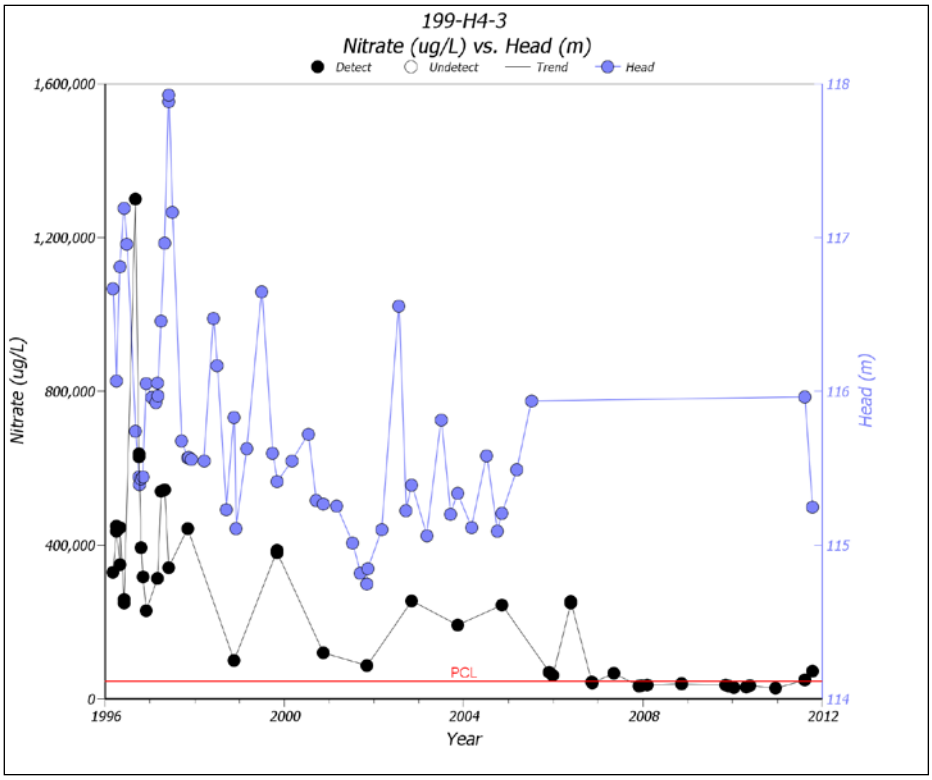


Figure 6. Nitrate Concentrations in Well 199-H4-3 Exceeded the Permit Concentration Limit

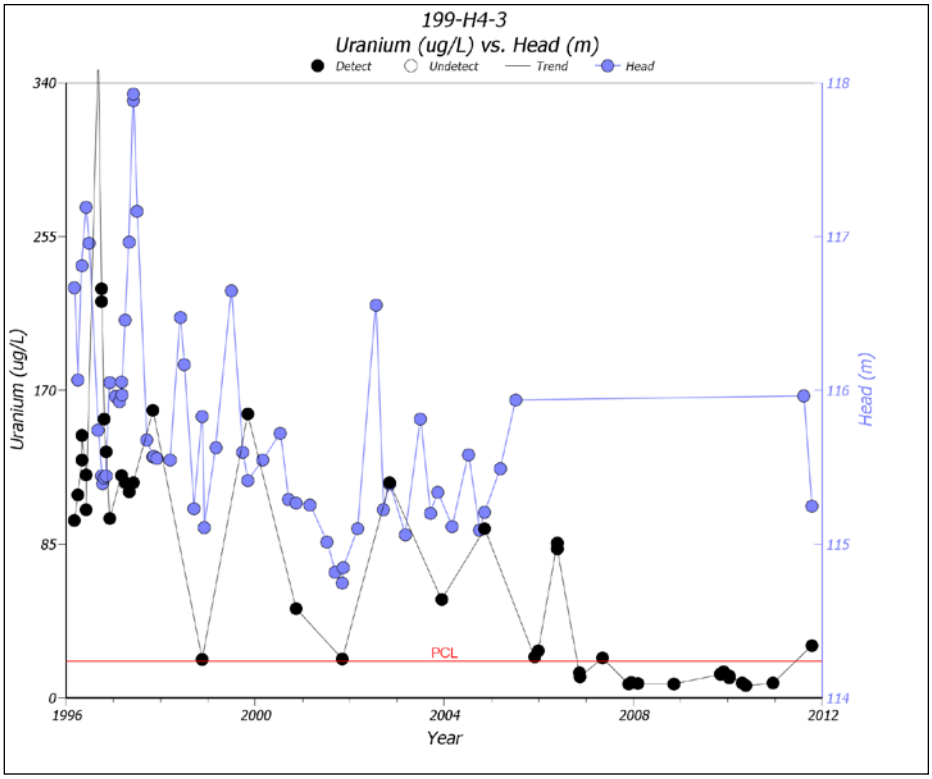
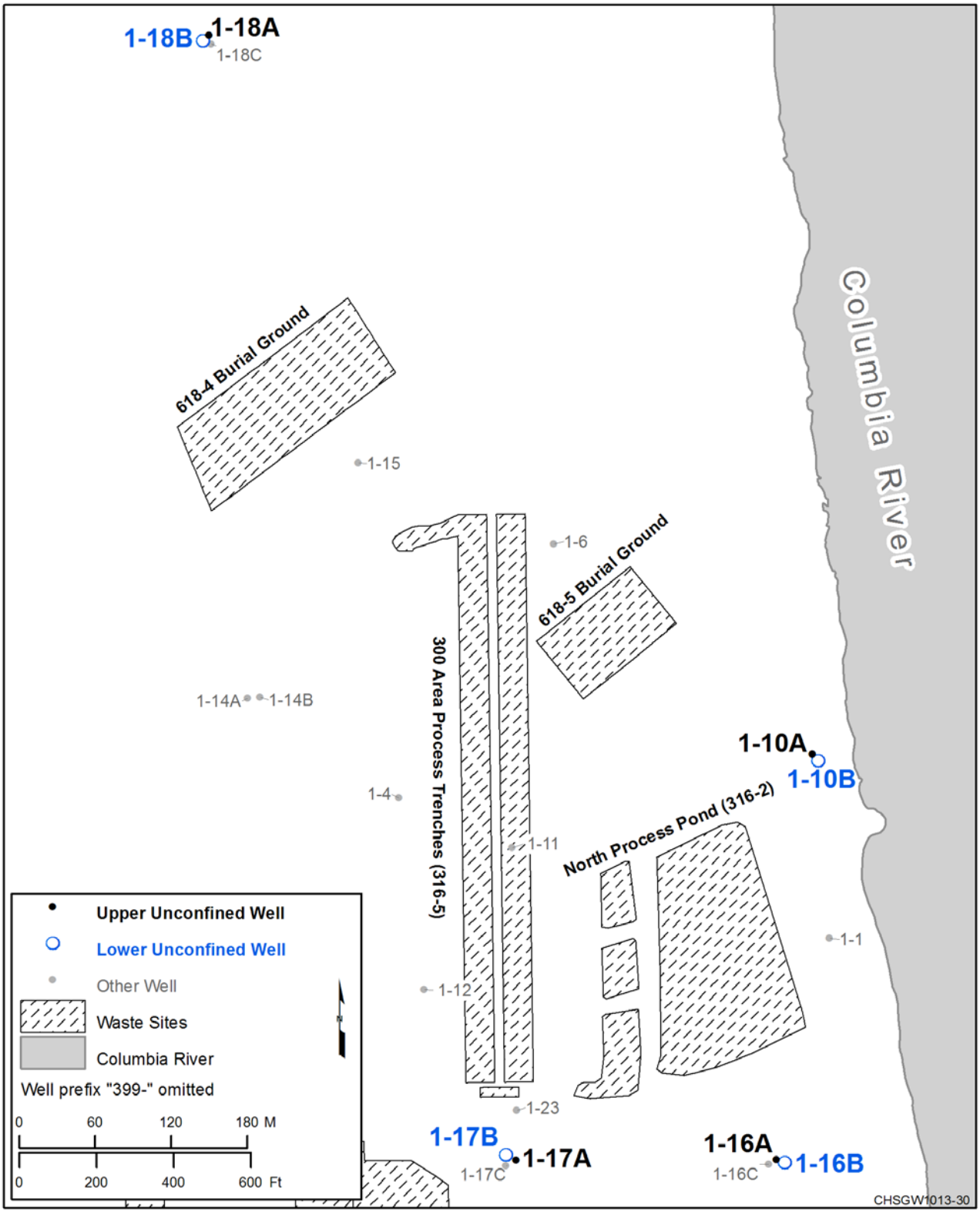


Figure 7. Uranium Concentrations in Well 199-H4-3 Exceeded the Concentration Limit



Note: Well locations are shown in large lettering.

Figure 8. Monitoring Well Locations for the 300 Area Process Trenches

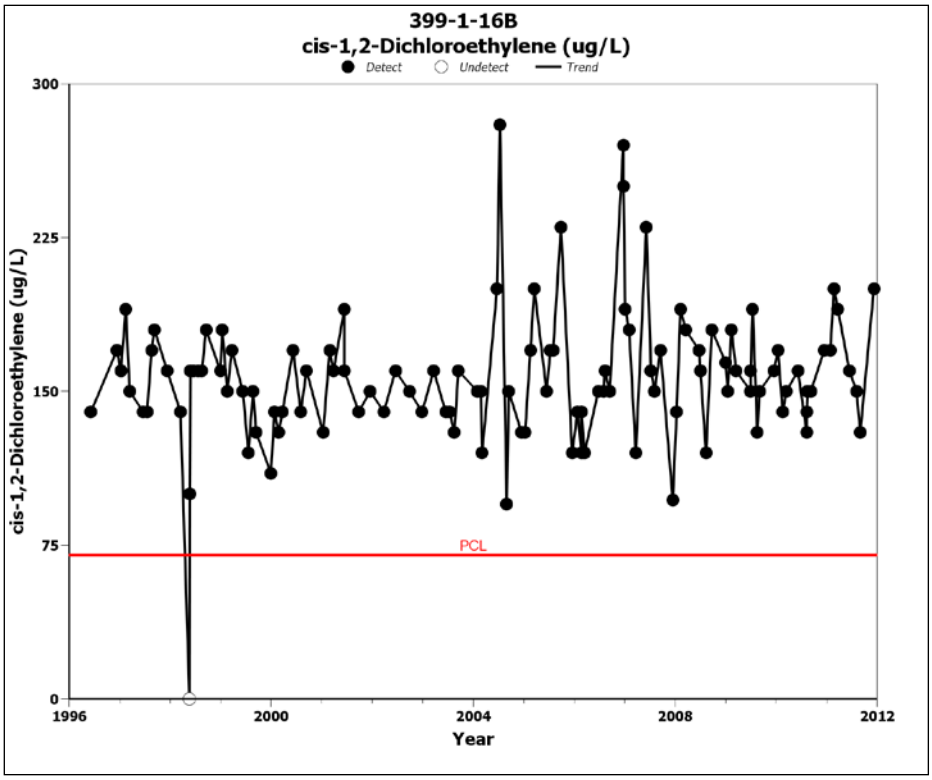


Figure 9. Cis-1,2-Dichloroethene Concentrations in Well 399-1-16B

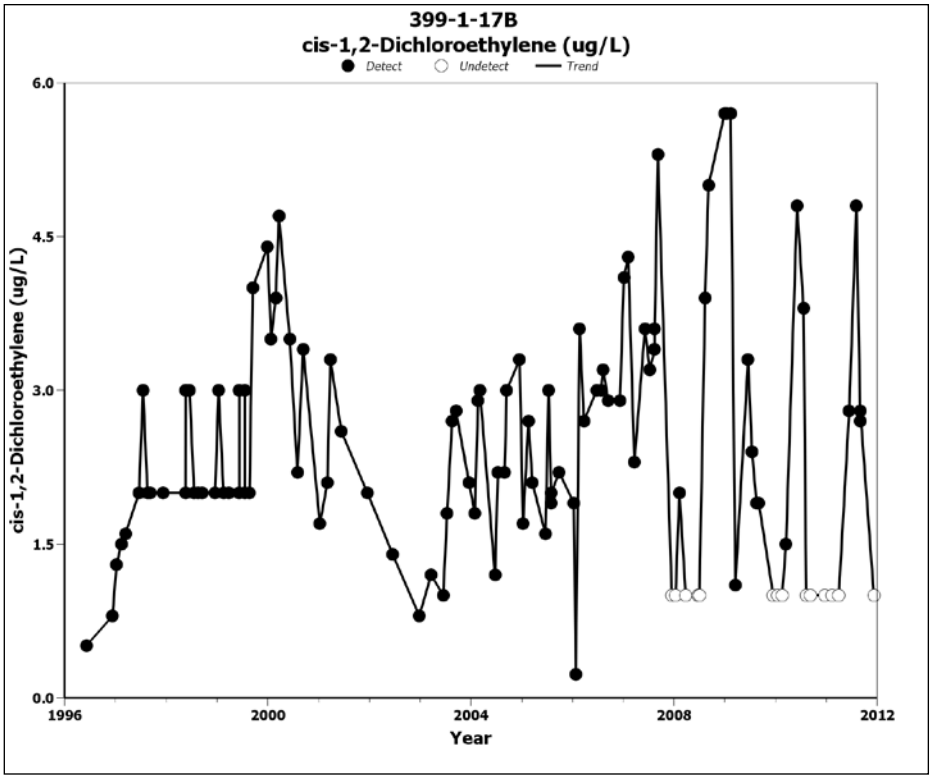


Figure 10. Cis-1,2-Dichloroethene Concentrations in Well 399-1-17B

2.4 183-H Basins Conclusions

From July through December 2011, chromium concentrations in the unconfined aquifer remained below permit concentration limits. Fluoride measurements in the 183-H wells remain far below the permit concentration limits. Concentrations of nitrate and uranium exceeded the permit concentration limit in this reporting period. The increase observed for nitrate (in both August and October samples from 199-H4-3) is most likely related to movement of existing nitrate in the aquifer. Uranium observed above the permit concentration in the October sample (199-H4-3) may be related to newly mobilized uranium from the rewetted zone after seasonal river stage changes, or movement of existing uranium in the aquifer. The source of the uranium increases will become clear as additional water level and uranium measurements are made.

Concentrations of hexavalent chromium in 199-H4-12C result from historical releases, and remain above permit concentration limits and CERCLA RAOs. With addition of 199-H4-12C to the pump-and-treat system, corrective action through the CERCLA interim action remains effective.

3 300 Area Process Trenches

The 300 Area Process Trenches are permitted as a RCRA treatment, storage, and/or disposal unit in post-closure corrective action monitoring. From 1975 to 1994, the trenches received effluent discharges of dangerous mixed waste from fuel fabrication and research laboratories in the 300 Area. The site was remediated in the 1990s. Groundwater monitoring at the 300 Area process trenches is conducted in accordance with WAC 173-303-645(11) and the Hanford Facility RCRA Permit (WA7890008967), Part VI, Chapter 1. The closure plan (DOE/RL-93-73, *300 Area Process Trenches Modified Closure Plan and Part A, Form 3*) indicates groundwater corrective action will be addressed as part of the remediation for the CERCLA 300-FF-5 Groundwater OU. The waste site designation is 316-5.

The objective of groundwater monitoring is to demonstrate the effectiveness of the corrective action program by confirming that trends in the data for groundwater constituents reflect natural attenuation, as expected by the CERCLA record of decision (EPA 1996b, *Declaration of the Record of Decision for the USDOE Hanford 300 Area 300-FF-1 and 300-FF-5 Operable Units, Hanford Site, Benton County, Washington*). The 300 Area Process Trenches were closed under a modified closure/post closure plan (DOE/RL-93-73) and remain in the groundwater corrective action program because groundwater contamination continues to exceed CERCLA RAOs and Hanford Facility RCRA Permit (WA7890008967) concentration limits.

3.1 300 Area Process Trenches RCRA Groundwater Monitoring Program

The permit concentration limits established for the 300 Area Process Trenches are provided in Table 3. RCRA corrective action monitoring will continue to evaluate new analytical results relative to permit concentration limits.

The groundwater monitoring network for the 300 Area Process Trenches (WHC-SD-EN-AP-185, *Groundwater Monitoring Plan for the 300 Area Process Trenches*) includes four well pairs (Figure 8). Each of the well pairs has one shallow and one deep well. The shallow wells are screened at the water table, and the deep wells are screened at the bottom of the unconfined aquifer (above the lacustrine and over-bank deposits of the Ringold Formation lower mud unit). One well pair is upgradient and the other three pairs are downgradient of the process trenches. The wells are monitored for the constituents in Table 4. The reporting period is semiannual, but wells are sampled four times (monthly intervals) in each reporting period in order to collect the required number of independent samples. As a result, the wells are sampled during the months of December, January, February, March, and June, July, August, September. Data from

300-FF-5 Groundwater OU sampling are used as supplementary information to construct larger-scale water table and uranium-concentration maps that extend beyond the area of the 300 Area Process Trenches network.

Table 3. Permit Concentration Limits for 300 Area Process Trenches

Dangerous Waste Constituents	Concentration Limit
cis-1,2-Dichloroethene	70 µg/L – DWS
Trichloroethene	5 µg/L – DWS
Other 300 Area Process Trenches Waste Constituent	**Concentration Limit**
Uranium (total; chemical analysis)	20 µg/L – proposed DWS when monitoring plan written (1996)

DWS = drinking water standard

During the July through December 2011 reporting period, the 300 Area Process Trenches post-closure monitoring wells were sampled during July, August, September, and December. Wells 399-1-10A, 399-1-16A, and 399-17A were sampled in April and May for the CERCLA interim action. Uranium data from those sampling events are included in the discussions of Section 3.2.

3.2 300 Area Process Trenches Contaminant Trends

This section discusses concentrations of cis-1,2-dichloroethene, trichloroethene, and uranium measured during the reporting period. Table 4 lists the analytical results for contaminants measured in each well.

Table 4. Groundwater Data for 300 Area Process Trenches, January through June 2010

Well	Date	Sampling Purpose	cis-1,2-Dichloroethene (µg/L)		Trichloroethene (µg/L)		Uranium (µg/L)	
Permit Concentration Limit*			***70***		***5***		***20***	
399-1-10A	7/14/2011	RCRA	1	U	1	U	11.6	D
	8/4/2011	RCRA	1	U	1	U	17.3	D
	9/12/2011	RCRA	1	U	1	U	**45**	
	12/8/2011	RCRA	1	U	1	U	**43.5**	D
399-1-10B	7/14/2011	RCRA	1	U	1	U	0.1	UD
	8/4/2011	RCRA	1	U	1	U	0.2	UD
	8/31/2011	RCRA	1	U	1	U	0.2	UD
	12/8/2011	RCRA	1	U	1	U	0.1	UD
399-1-16A	7/21/2011	RCRA	1	U	1	U	**20.7**	D
	8/4/2011	RCRA	1	U	1	U	**26.9**	D
	8/31/2011	RCRA	1	U	1	U	**35.3**	D
	12/8/2011	RCRA	1	U	1	U	**100**	D

Table 4. Groundwater Data for 300 Area Process Trenches, January through June 2010

Well	Date	Sampling Purpose	cis-1,2-Dichloroethene (µg/L)		Trichloroethene (µg/L)		Uranium (µg/L)	
399-1-16B	8/4/2011	RCRA	**150**		1.9	J	9.67	D
	8/31/2011	RCRA	**130**		1.4	J	8.91	D
	12/8/2011	RCRA	**200**	Q	1.4	J	9.46	D
399-1-17A	7/14/2011	RCRA	1	U	1	U	**441**	DF
	8/4/2011	RCRA	1	U	1	U	**375**	D
	8/31/2011	RCRA	1	U	1	U	**301**	D
	12/8/2011	RCRA	1	U	1	U	**97.9**	D
399-1-17B	8/4/2011	RCRA	4.8	J	1	U	0.2	UD
	9/1/2011	RCRA	2.8	J	1	U	0. 2	UD
	12/8/2011	RCRA	1	U	1	U	0.1	UD
399-1-18A	7/21/2011	RCRA	1	U	1	U	5.68	D
	8/4/2011	RCRA	1	U	1	U	6.51	D
	8/31/2011	RCRA	1	U	1	U	5.94	D
	12/8/2011	RCRA	1	U	1	U	5.78	D
399-1-18B	8/4/2011	RCRA	1	U	1	U	0.2	UD
	9/1/2011	RCRA	1	U	1	U	0.2	UD
	12/8/2011	RCRA	1	U	1	U	0.1	UD

Notes: Analyses are from unfiltered samples unless otherwise noted.

Italics indicates Permit Concentration Limits

Shading indicates filtered samples.

Bold emphasis added where the result exceeded the permit concentration limit.

* Concentration limits defined in the Hanford Facility RCRA Permit, Part VI, Post-Closure Unit 2

Qualifiers:

D = reported value is after dilution
F = filtered sample
J = estimated value
U = below the detection limit
Q = associated quality control sample was out of limits

Cis-1,2-dichloroethene was observed in two wells in the 300 Area Process Trenches network during the reporting period (399-1-16B, and 399-1-17B). The “B” wells are screened in the lower portion of the unconfined aquifer. Only Well 399-1-16B had concentrations of cis-1,2-dichloroethene that exceeded the 70 µg/L concentration limit. While slightly higher than last reporting period, the trend at Well 399-1-16B (Figure 9) was stable, ranging from 130 to 200 µg/L. Figure 10 depicts concentrations in Well 399-1-17B, which ranged from below than detection limit to 4.8 µg/L. This maximum observation is flagged “J” by the laboratory, indicating it is an estimated value. The current method detection limit is 1 µg/L.

During the reporting period, trichloroethene did not exceed the 5 µg/L permit concentration limit in any of the network wells (Figure 11). Three measurements (two in August and one in December) from Well 399-1-16B observed trichloroethene at concentrations between 1.4 µg/L and 1.9 µg/L. Each of these values were flagged "J" by the laboratory, indicating an estimated value. The current method detection limit is 1 µg/L.

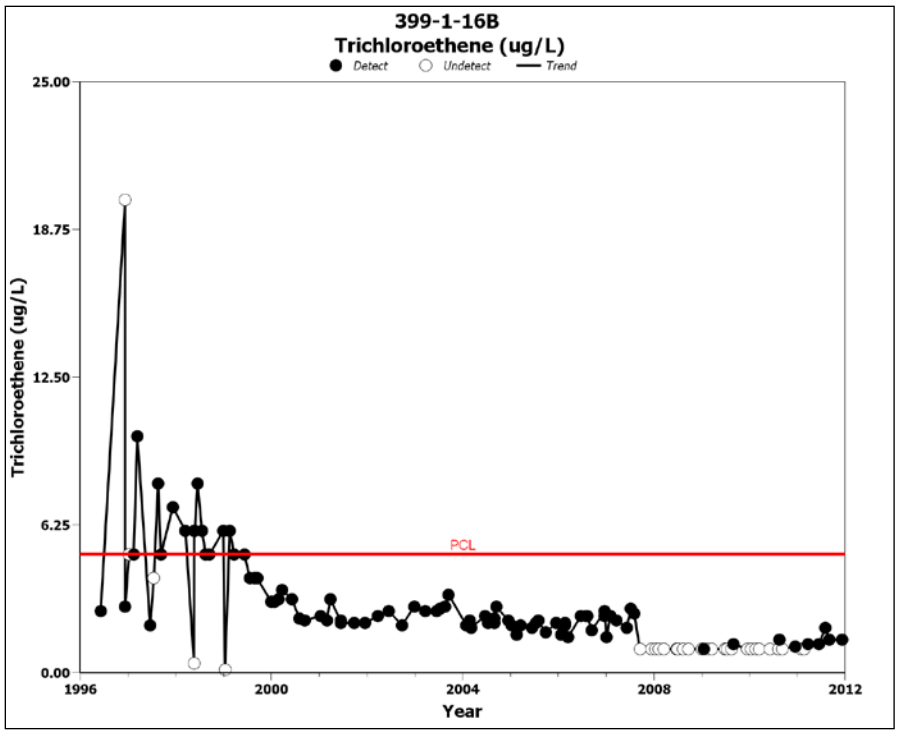


Figure 11. Trichloroethene Concentrations in Well 399-1-16B

A persistent uranium plume underlies a large portion of the 300 Area. Uranium concentrations continued to exceed the permit concentration limit (20 µg/L) at Wells 399-1-10A, 399-1-16A, and 399-1-17A. These three downgradient wells are screened at the water table. Uranium concentration trends at Wells 399-1-10A and 399-1-16A (Figures 12 and 13, respectively), tend to be highest in the fall and winter when water levels are low, and decline in spring and early summer when water levels are high. This trend is typical for these wells, which are located near the Columbia River.

The June 2011 sample result from 399-1-17 was initially reported at 96 µg/L. However, a split from that sample had a concentration of over 2,000 µg/L. Because of this irregularity, the initial sample was reanalyzed. The result from the reanalysis was 4,030 µg/L. These values are abnormally high. The previous maximum concentration at that well was 155 µg/L in June of 2006.

The interaction of groundwater with the contaminated soil column, especially at the rewetted zone where the contaminant is more readily available to the groundwater, allows for ongoing release to the groundwater during periods of high water. These contaminants may continue to enter the aquifer water by dissolution, diffusion, or ionic exchange processes as the water table fluctuates and re-wets the soil matrix. River stage in the time period of the high value was one of the highest on record, at a flow of 829,389,110 m^3/day (339,000 ft^3/second) and a gauge height of just over 8.8 m (29 ft). This resulted in an unusually high water table at the waste site, allowing for uranium trapped in the usually dry soil to be released to the water column. As the water table dropped, the uranium concentrations also declined, further supporting this theory.

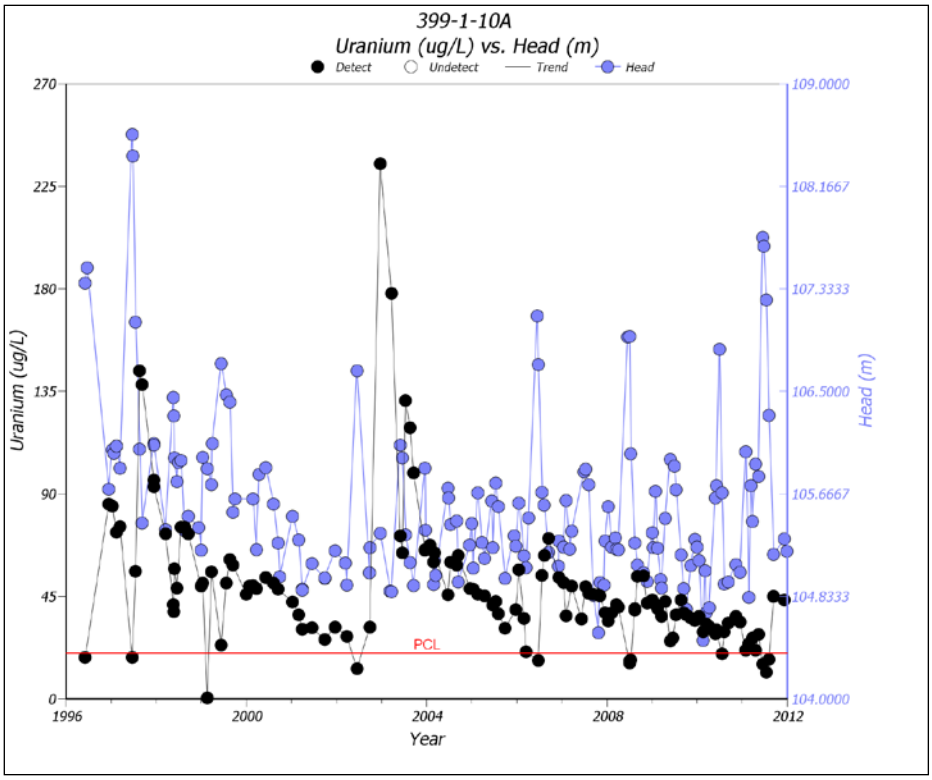


Figure 12. Inversely Related Uranium Concentrations and Water Level in Well 399-1-10A

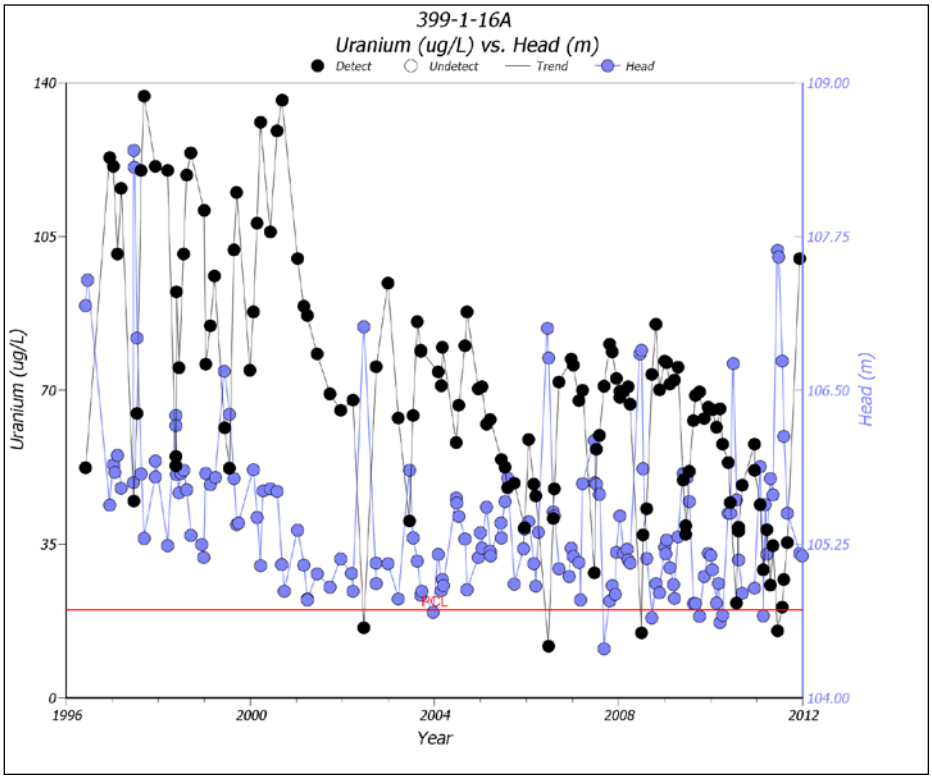


Figure 13. Inversely Related Uranium Concentrations and Water Level in Well 399-1-16A

Values reported during July and August from 399-1-17A continued to be much higher than normal, ranging from 301 µg/L to 441 µg/L (the maximum value is under technical review). Normally an increase is expected during this timeframe because of the change in river stage, but the magnitude of the July increase is inconsistent with the past seasonal fluctuations (Figure 14). The December 2011 sample yielded a uranium concentration of 97.9 µg/L, which is consistent with observed seasonal concentrations.

The uranium concentration at Well 399-1-17A (located farther from the river) tends to be lowest in the fall and winter, when water levels are low (Figure 14). The relationship of water levels and uranium concentration in the 300 Area is described in detail in PNNL-17034, *Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington*.

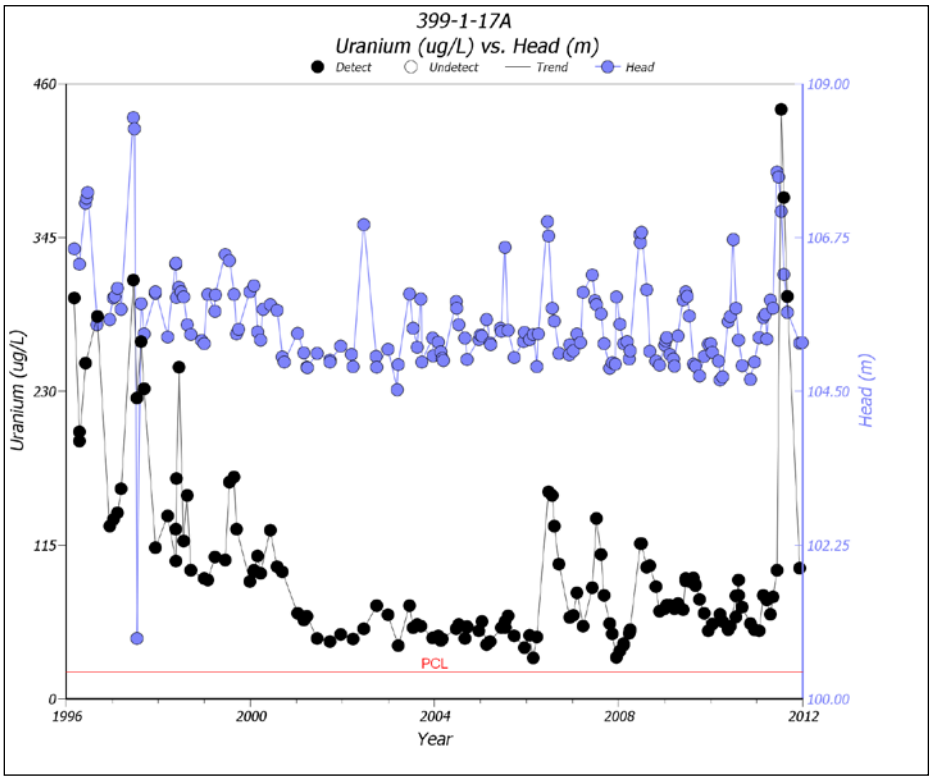


Figure 14. Directly Related Uranium Concentrations and Water Level in Well 399-1-17A

3.3 300 Area Process Trenches Conclusions

Concentrations of cis-1,2-dichloroethene and uranium have not attenuated as quickly as expected under the CERCLA record of decision. The concentration of cis-1,2-dichloroethene continued at levels above the concentration limit (70 µg/L) in one well (399-1-16B) and is not affected by river stage, as shown in the previous semiannual report (SGW-52135).

Three wells downgradient of the 300 Area Process Trenches and screened at the water table (399-1-10A, 399-1-16A, and 399-1-17A) continued to have uranium concentrations that exceeded the 20 µg/L permit concentration limit. Normally, overall trends at these wells for the last few years are relatively stable, although uranium concentrations occasionally increase or decrease temporarily. These variations are caused by seasonal water table and river-level fluctuations that, in turn, alter groundwater chemistry and affect uranium adsorption in the aquifer. This trend continued in Wells 399-1-10A and 399-1-16A.

Contaminants within the periodically rewetted zone are readily available to the groundwater as the water table rises and falls during the year. A very high river stage occurred in May/June of 2011 resulting in an unusually high water table at the waste site, allowing for uranium trapped in the usually dry soil to be released to the water column and causing the high concentrations found in June at Well 399-1-17. Based on a review of the data, the initially reported 96 µg/L was reanalyzed and corrected to a value of 4,030 µg/L.

The values reported during July and August from 399-1-17A were abnormally high, ranging from 301 µg/L to 441 µg/L. Normally, an increase is expected during this timeframe because of the change in river stage, but the magnitude of the increase in July is not consistent with the seasonal fluctuations. The December 2011 sample yielded a uranium concentration of 97.9 µg/L, which is representative of seasonal concentrations.

Trichloroethene concentrations remained below the concentration limit (5 µg/L) during the reporting period. However, monitoring of this volatile organic will continue in compliance with the groundwater monitoring plan.

Corrective actions through the CERCLA interim action (attenuation and institutional controls) have been effective for trichloroethene, and moderately effective for uranium. The CERCLA RI/FS for the 300-FF-5 OU further evaluates the feasibility of remedies for these constituents.

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